Expresso Model Validation and Transformation

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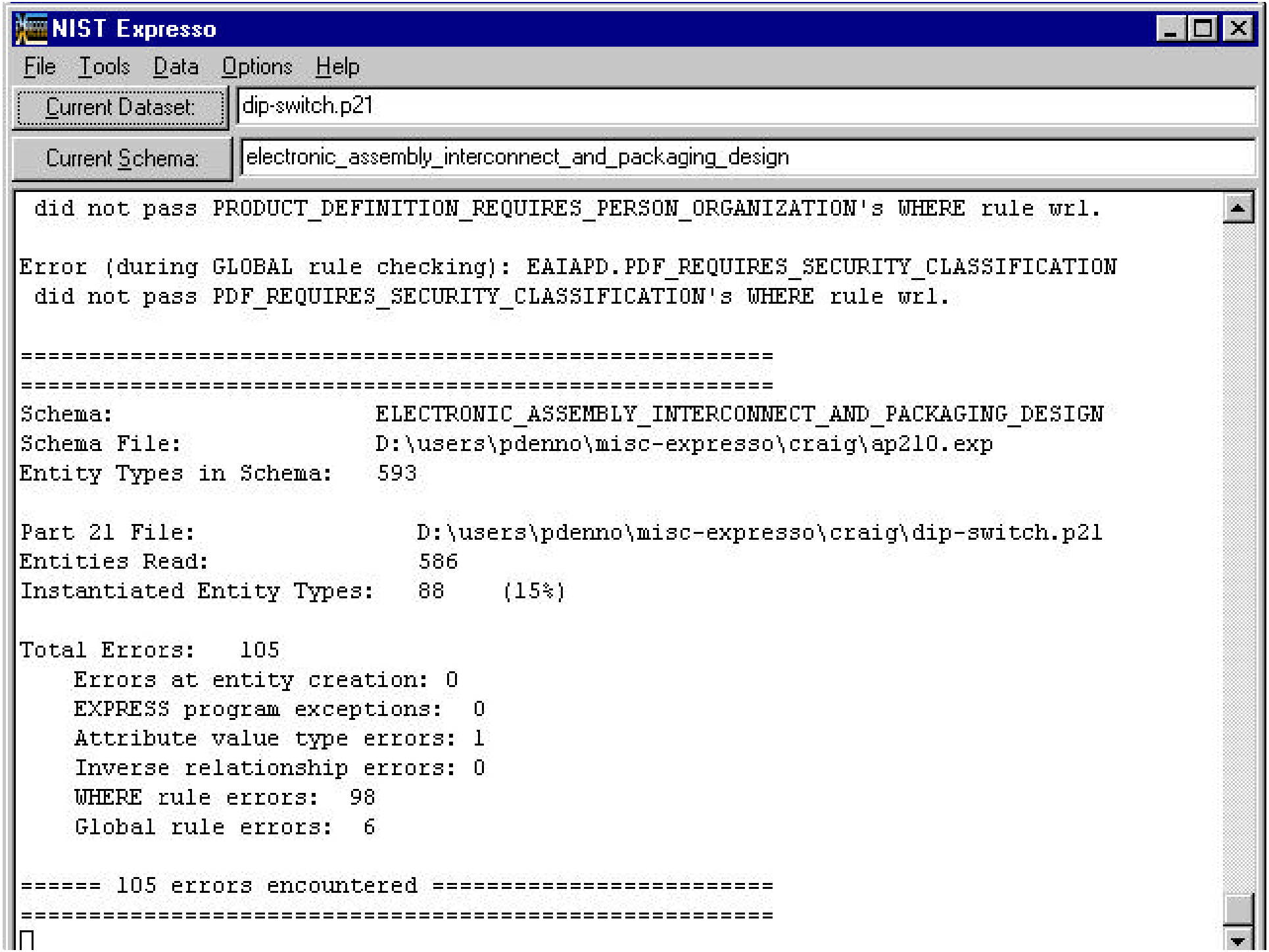
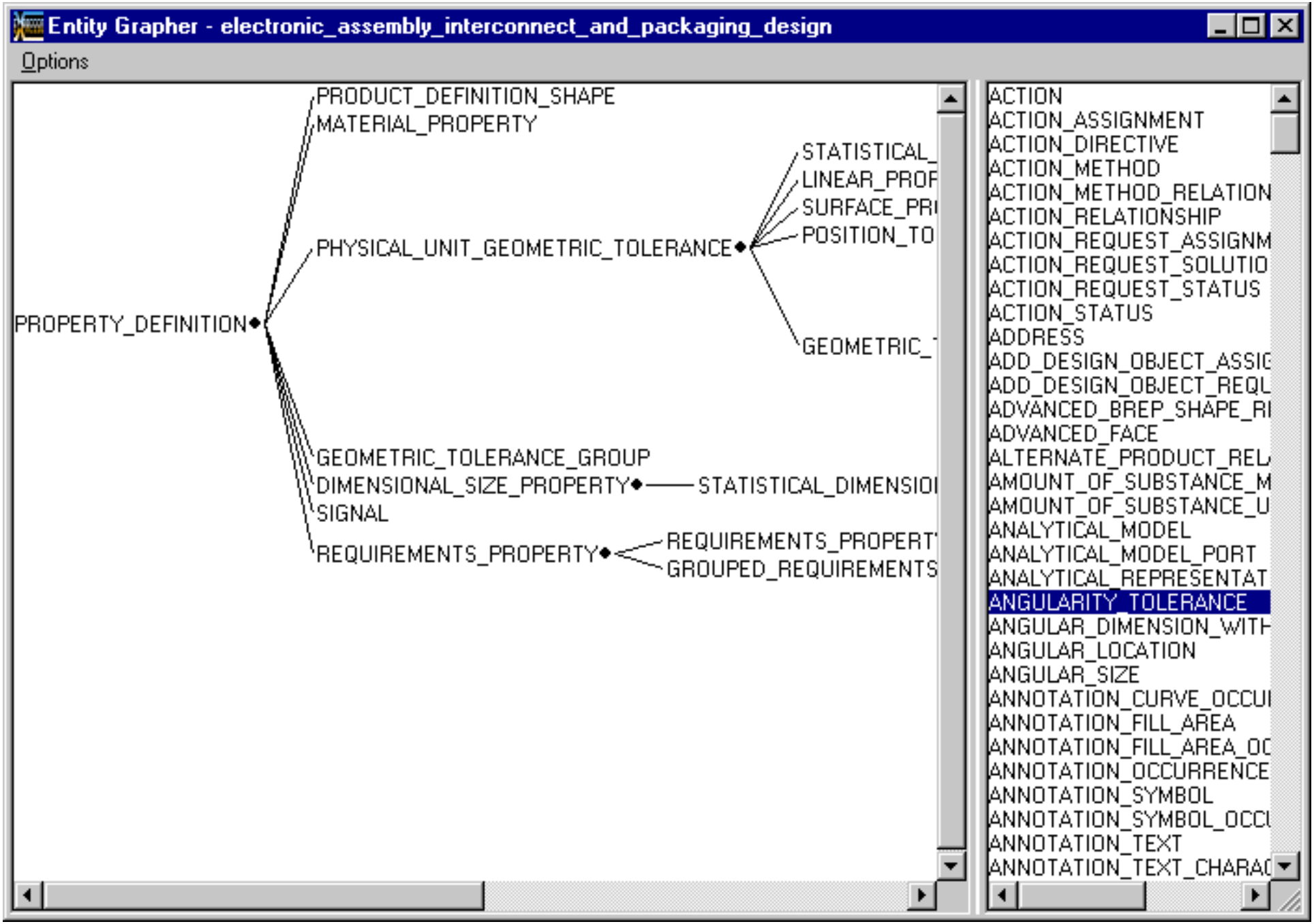
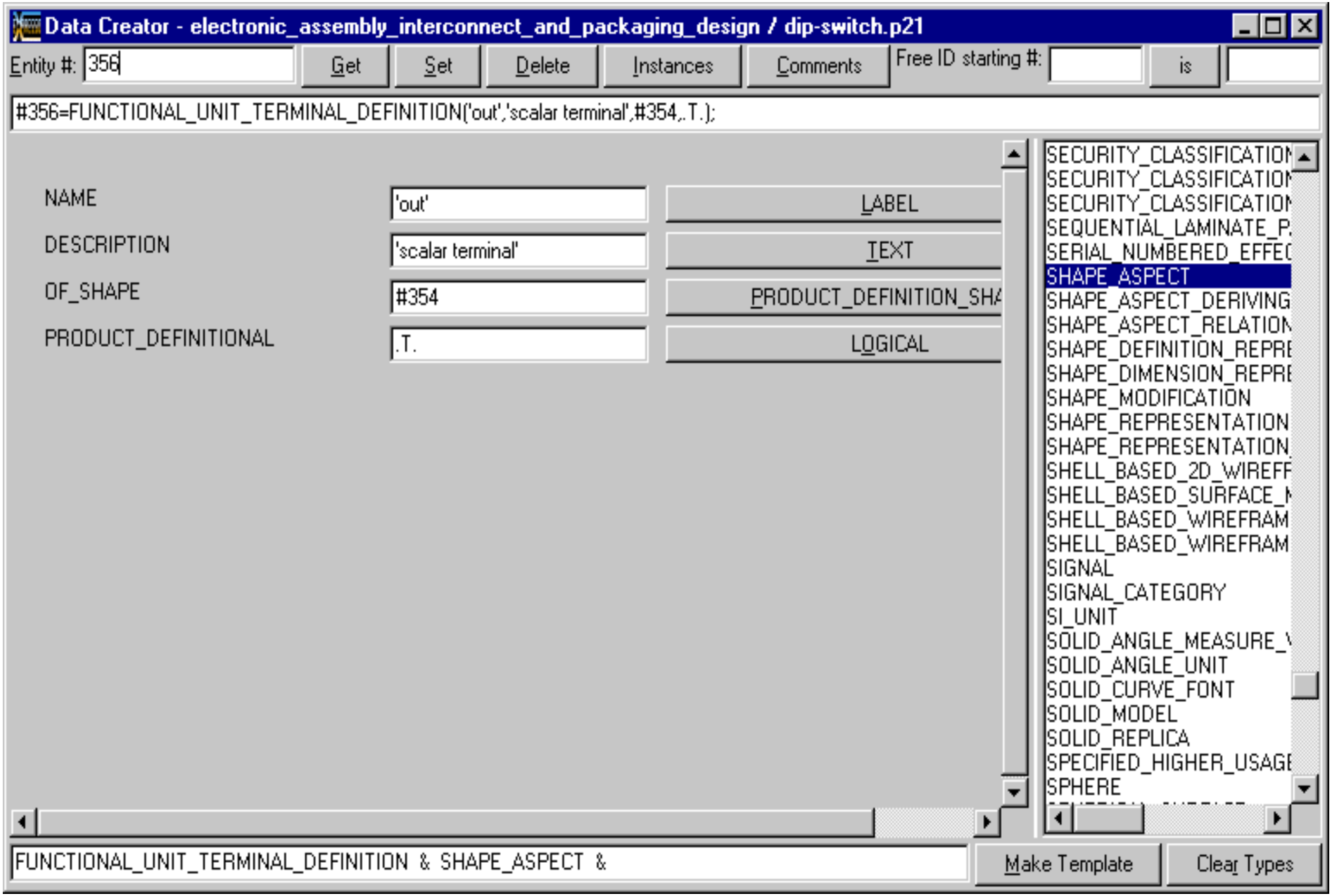
Expresso: What is it?

- Public domain software developed at NIST
- EXPRESS information model validation tool.
- Information mapping tool based on Express-X
- Core software for projects in testing, validation, and information mapping.
- Implements nearly all of EXPRESS including evaluation of expressions in rules against a data population.
- Reads EXPRESS and dynamically generates class definitions and programs representing the EXPRESS constraints.


NIST Expresso
File Tools Data Options Help
Current Dataset:
dip-switch.p21
Current Schema:
electronic_assembly_interconnect_and_packaging_design
did not pass PRODUCT_DEFINITION_REQUIRES_PERSON_ORGANIZATION's WHERE rule wrl.
Error (during GLOBAL rule checking): EAIAPD.PDF_REQUIRES_SECURITY_CLASSIFICATION
did not pass PDF_REQUIRES_SECURITY_CLASSIFICATION's WHERE rule wrl.
Schema: ELECTRONIC_ASSEMBLY_INTERCONNECT_AND_PACKAGING_DESIGN
Schema File: D:\users\pdenno\misc-expresso\craig\ap210.exp
Entity Types in Schema: 593
Part 21 File: D:\users\pdenno\misc-expresso\craig\dip-switch.p21
Entities Read: 586
Instantiated Entity Types: 88 (15%)
Total Errors: 105
Errors at entity creation: 0
EXPRESS program exceptions: 0
Attribute value type errors: 1
Inverse relationship errors: 0
WHERE rule errors: 98
Global rule errors: 6
====== 105 errors encountered ==========


Entity Grapher - electronic_assembly_interconnect_and_packaging_design
Options
PRODUCT_DEFINITION_SHAPE
MATERIAL_PROPERTY
PHYSICAL_UNIT_GEOMETRIC_TOLERANCE
PROPERTY_DEFINITION
GEOMETRIC_TOLERANCE_GROUP
DIMENSIONAL_SIZE_PROPERTY
SIGNAL
REQUIREMENTS_PROPERTY
ACTION
ACTION_ASSIGNMENT
ACTION_DIRECTIVE
ACTION_METHOD
ACTION_RELATIONSHIP
ACTION_STATUS
ADDRESS
ADVANCED_FACE
ANALYTICAL_MODEL
ANGULARITY_TOLERANCE
ANGULAR_LOCATION
ANGULAR_SIZE
ANNOTATION_FILL_AREA
ANNOTATION_SYMBOL
ANNOTATION_TEXT


Data Creator - electronic_assembly_interconnect_and_packaging_design / dip-switch.p21
Entity #: 356
Get
Set
Delete
Instances
Comments
Free ID starting #:
is
#356=FUNCTIONAL_UNIT_TERMINAL_DEFINITION('out','scalar terminal',#354,.T.);
NAME
'out'
LABEL
DESCRIPTION
'scalar terminal'
TEXT
OF_SHAPE
#354
PRODUCT_DEFINITION_SHA
PRODUCT_DEFINITIONAL
.T.
LOGICAL
SECURITY_CLASSIFICATION
SECURITY_CLASSIFICATION
SECURITY_CLASSIFICATION
SEQUENTIAL_LAMINATE_P
SERIAL_NUMBERED_EFFEC
SHAPE_ASPECT
SHAPE_ASPECT_DERIVING
SHAPE_ASPECT_RELATION
SHAPE_DEFINITION_REPRE
SHAPE_DIMENSION_REPRE
SHAPE_MODIFICATION
SHAPE_REPRESENTATION
SHAPE_REPRESENTATION
SHELL_BASED_2D_WIREFF
SHELL_BASED_SURFACE_M
SHELL_BASED_WIREFRAM
SHELL_BASED_WIREFRAM
SIGNAL
SIGNAL_CATEGORY
SI_UNIT
SOLID_ANGLE_MEASURE_V
SOLID_ANGLE_UNIT
SOLID_CURVE_FONT
SOLID_MODEL
SOLID_REPLICA
SPECIFIED_HIGHER_USAGE
SPHERE
FUNCTIONAL_UNIT_TERMINAL_DEFINITION & SHAPE_ASPECT &
Make Template
Clear Types

Information Model Validation

- An EXPRESS schema defines the domain of valid data.
- Data communicates desired behavior
- STEP schemas do not define many geometric constraints
- Constraints may specify
  - the domain of values of an attribute;
  - a relationship among attributes of an instance
  - the valid compositions of type
  - the requirement for the existence of a relationship
  - the uniqueness of some combination of instance attributes
  - a requirement for the presence or absence of a pattern or network that might involve several entity instances.

Express-X Information Mapping

- Express-X : a structural data mapping language.
- Allows the specification of the relationship between models.
  - Without adding to information content
- Two conformance classes
  - Viewing, Schema to Schema mapping
- Uses of mapping:
  - Translation (file to file)
  - Viewing (information gathering)
  - Object instance synthesis
  - Schema/Repository level data integration and file synthesis
  - STEP mapping table documentation

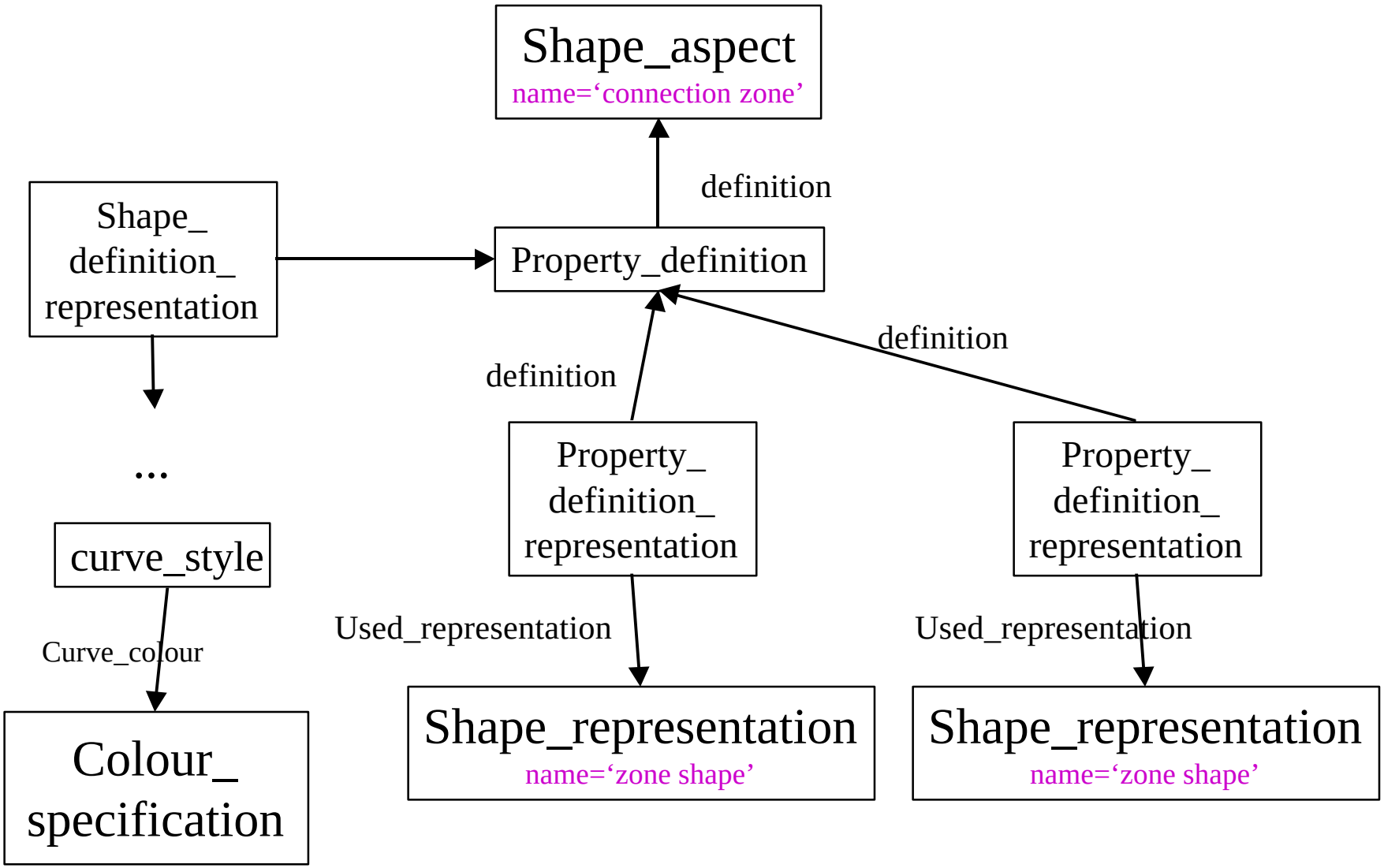
Mapping Engine, Mapping Specification

- The mapping engine and mapping specification are separate entities. This approach has its advantages:
  - Software reuse
  - The specification is documentation
  - Opportunities for dynamic mapping specification
- These advantages extend to other mapping approaches also (e.g. mapping meta-model).

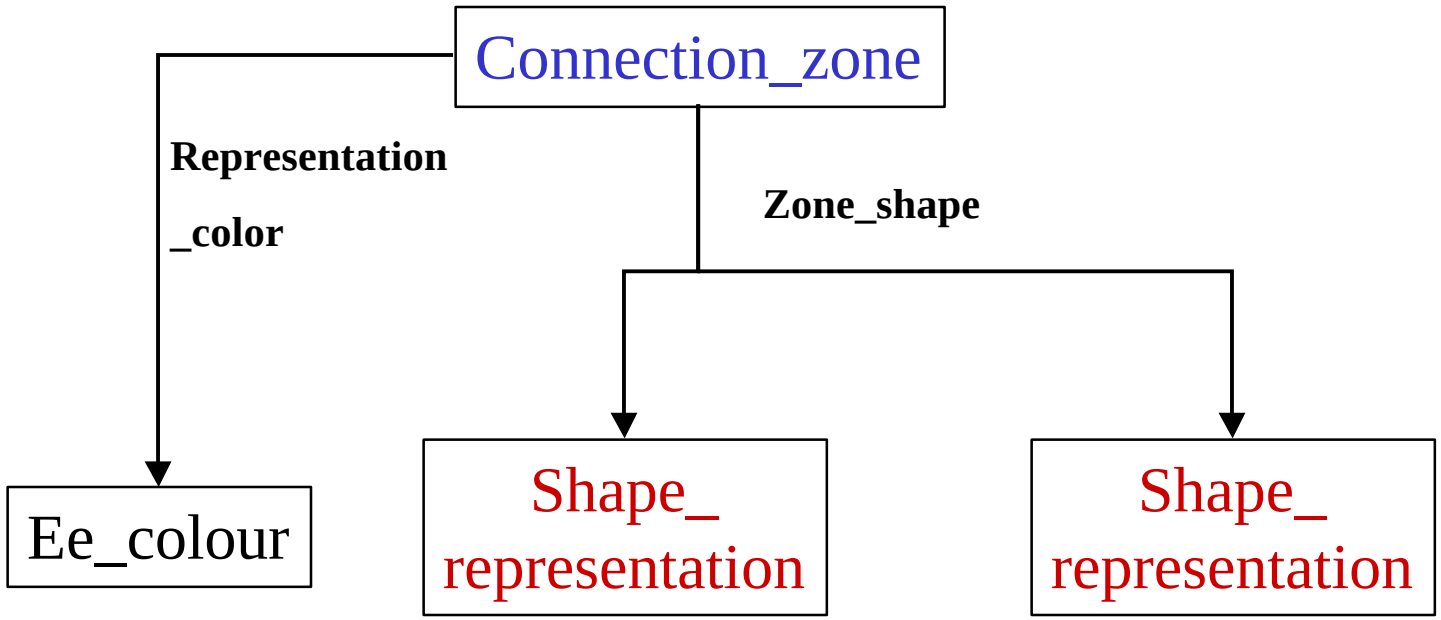
Mapping Example

AP210 ARM Object: Connection_zone to AP210 AIM Entities

AIM Instance Graph



ARM Instance Graph



Mapping From One Connection Zone to Multiple Property_definition_representations

```
MAP arm_connection_zone_shapes AS
  pdr : LIST [0:?] OF aim.property_definition_representation;
FROM cz : arm.connection_zone;
FOR EACH shape IN cz.zone_shape INDEXING i;
SELECT
  pdr[i].used_representation := sr@arm_zone_shape(shape);
  pdr[i].definition := pd@arm_connection_zone(cz);
END_MAP; -- connection_zone_shapes
```

Shape_representation Called for in Previous Explicit Binding

```
MAP arm_zone_shape AS
  sr : aim.shape_representation;
  rc : aim.representation_context;
FROM
  asr: arm.shape_representation;
SELECT
  rc.context_identifier := '';
  rc.context_type := '';
  sr.name := 'zone shape';
  sr.context_of_items := rc;
END_MAP; -- arm_cz_zone_shape
```

Map of Connection_zone to Shape_aspect and Ancillary Entities

```
MAP arm_connection_zone AS
  sa   : aim.shape_aspect;
  pd   : aim.property_definition;
  pdr  : aim.property_definition_representation;
  rc   : aim.representation_context;
  rep  : aim.representation;
FROM cz : arm.connection_zone;

…
END_MAP;
```

Current and Possible Future Implementation Work

- Continue to track and implement Express-X
- PDM Enablers interface
- “EXPRESS-free” validation tool for STEP schema
- EXPRESS amendment, EXPRESS 2
- More compile time EXPRESS schema checking
- Short-form schema capability

Expresso Availability

- Http://www.nist.gov/expresso
  - Windows 95/NT
  - Solaris Command Line Version
  - Linux?